Annals of Clinical and Analytical Medicine
Original Research

Short-term results in mid and low rectal cancer with laparoscopic and open surgery

Minimally invasive rectal cancer surgery

Serdar Şenol[1], Servet Karagül[1], Oktay Karaköse[2]
[1] Department of Gastroenterological Surgery
[2] Department of Surgical Oncology, SBÜ Samsun Training and Research Hospital, Samsun, Turkey

Abstract
Aim: The aim of this study was to compare rectal cancer patients who underwent open and laparoscopic surgery in terms of their short-term surgical and oncological outcomes.
Material and Methods: We retrospectively evaluated data of 71 patients with mid and low rectal cancer who underwent elective curative laparoscopic and open total mesorectal excision between January 2017 and December 2019.
Results: The operative time was longer (192 min. vs 173 min., p=0.059), the estimated blood loss was less (75 ml vs 150 ml, p=0,03), and the length of incision was obviously shorter in the laparoscopy group (5 cm vs 18 cm, p=0.01). There was no mortality in any of the groups. The overall morbidity rate was 25% in the open group and 17.94% in the laparoscopy group (p=0.469). Revision surgery was needed in 9.38% of the patients in the open group, 12.8% in the laparoscopy group (p=0.648). In the laparoscopy group, the cause of revision surgery was anastomotic leak for all patients. The median lymph node number was higher in the laparoscopy group. There was no significant difference in terms of surgical margins, surgical methods, time of initiation of oral intake and first flatus, and hospital stay. During the follow-up period, 2 patients (6.25%) in the open group had a local recurrence, and five patients (12.8%) in the laparoscopy group had distant metastasis.
Discussion: Laparoscopic surgery is a safe and effective method that can be used in the treatment of mid-low rectal cancer.

Keywords
Laparoscopy, Morbidity, Mortality, Rectal Cancer, Total Mesorectal Excision

DOI: 10.4328/ACAM.20827 Received: 2021-08-21 Accepted: 2021-10-07 Published Online: 2021-10-09 Printed: 2022-01-01 Ann Clin Anal Med 2022;13(1):30-34
Corresponding Author: Serdar Şenol, Samsun Eğitim ve Araştırma Hastanesi, Gastroeneteroloji Cerrahi Kliniği, Samsun, Turkey.
E-mail: serdarardaduru@gmail.com P: +90 362 315 15 00
Corresponding Author ORCID ID: https://orcid.org/0000-0003-1193-1567

Introduction

Rectal cancer is the second most common type of cancer in developed countries, with a male to female ratio of 2–3:1 [1]. Treatment for locally advanced rectal cancers is neoadjuvant chemoradiotherapy followed by radical surgery, including total mesorectal excision (TME). Laparoscopic surgery is steadily replacing open surgery because it involves less blood loss, smaller surgical incisions, faster recovery, and shorter hospital stay [2]. However, the adoption of laparoscopic surgery for rectal cancer has been slower due to the difficulty of pelvic dissection and resulting concerns about the ability to perform TME equivalent to open surgery [3]. The aim of this study was to compare short-term surgical and oncologic outcomes of patients who underwent open and laparoscopic surgery for the treatment of the mid and low rectal cancer.

Material and Methods

This retrospective study included rectal cancer patients who underwent surgery at the Department of Gastrointestinal Surgery and Surgical Oncology of Samsun Training and Research Hospital, from January 2017 to December 2019. Ethical approval for the study was obtained from the Samsun Training and Research Hospital Ethics Committee (no: 2019/3/8). We retrospectively evaluated data related to 71 patients who underwent elective curative laparoscopic or open total mesorectal surgery (TME). The laparoscopic and open surgery groups were evaluated in terms of age, sex, ASA score, body mass index (BMI), neoadjuvant chemoradiotherapy, history of abdominal surgery, anastomosis characteristics, preventive ostomy, pathological stage, rates of pathologic complete response after neoadjuvant therapy, evaluation of distal and circumferential resection margins, number of excised lymph nodes, operative time, intraoperative blood loss, time of initiation of oral intake, first defecation time, length of hospital stay, mortality, morbidity rates and causes, reoperation rate, median follow-up time, disease free survival, local recurrence, distant metastases.

Statistical Analysis

Data analysis was performed using the IBM SPSS Statistics version 21 (Armonk, NY, USA) package software. The normality of data distributions was evaluated using the Kolmogorov-Smirnov test. Since all data were nonnormally distributed, the median, minimum, and maximum values were used to summarize the data, and the Mann-Whitney U test was used for intergroup comparisons. Percentage values were compared between groups using the chi-square test.

Results

In this study, 71 patients were enrolled (32 patients in the open group and 39 patients in the laparoscopic group). Patient characteristics between groups are shown in Table-1. The groups showed no statistically significant differences in median age, sex, BMI, ASA score, previous abdominal surgery, neoadjuvant chemoradiotherapy.

Intraoperative and postoperative outcomes are shown in Table-2. There was no statistically significant difference between the groups in terms of surgical methods used. Although there was no difference between the groups, the rate of preventive ostomy was higher in the open surgery group, and surgery time was longer in the laparoscopy group. Estimated blood loss was less and length of incision was obviously shorter in the laparoscopic group (p=0.01). No significant difference was observed either in the time of initiation of oral intake or in the time of first flatus. There was no significant difference in median length of hospital stay. There was no mortality in any of the groups. The specific postoperative complication rate was 25% in the open surgery group [anastomotic leak, anastomotic stenosis, surgical site infection] and 17.94% in the laparoscopic surgery group [anastomotic leak, anastomotic stenosis, surgical site infection, pneumonia, pelvic abscess, evisceration]. In the open surgery group, 9.38% of the patients required revision surgery, the main reasons for which were anastomotic leakage and evisceration. This rate was 12.8% in the laparoscopic surgery group and the cause was anastomotic leak. The difference was not significant between the groups in reoperation rates

Table 1. Demographic and clinical features

	Laparoscopic surgery n=39	Open surgery n=32	p value
Age (years)*	62 (27-78)	65 (36-81)	0.062
Sex			0.222
Female	10 (25.64%)	15 (46.87%)	
Male	29 (74.35%)	17 (53.12%)	
BMI (kg/m2)*	27.4 (17.6-37.1)	24.5 (20-39)	0.148
ASA Score			0.65
ASA 1	3 (7.7%)	3 (9.4%)	
ASA 2	26 (66.7%)	20 (62.5%)	
ASA 3	10 (25.6%)	9 (28.1%)	
ASA 4	-	-	
Tumor location (distance from anus, cm)	7.8±4.8	8.6±3.4	0.669
nCRT	19 (48.7%)	11 (34.37%)	0.223
Previous Surgery	8 (20%)	8 (25%)	0.653

nCRT: neoadjuvant chemoradiotherapy; LND: Lymph node dissection, BMI: Body mass index, ASA: American Society of Anesthesiologists Physical Status Classification, *: Data are shown as median (inter-quartile range)

Table 2. Surgical outcomes

	Laparoscopic surgery n=39		Open surgery n=32		p value
Intersphincteric Resection, Coloanal Anastomosis	3	7.9%	2	6.3%	0.870
Abdominoperineal Resection	2	5.3%	1	3.1%	
Low Anterior Resection	34	86.8%	29	90.6%	
28-mm Circular Stapler	13	38.2%	3	6.9%	
31-mm Circular Stapler	21	61.8%	26	89.7%	
34-mm Circular Stapler	-	-	1	3.4%	
Simultaneous Liver metastasectomy	2	5.1%	3	9.3%	
Protective Ileostomy	7	17.9%	7	21.9%	0.679
Estimated blood lossa (mL)	75	45 -135	150	85 - 225	0.03
Length of incision (cm)	5	5 - 6	18	16-18	0.01
Operative Time (min)	192.8	120-300	173	120-250	0.059
Time to the start of oral intake (days)	3	3-4	3	3-4	0.11
Time to first flatusa (days)	4	3-4	4	3-4	0.94
Length of hospital stay (days)	7	3-22	8	4-23	0.86
Morbidity	7	(17.94%)	8	(25%)	0.469
Mortality		-		-	

[a]: Data are shown as median (inter-quartile range)

Table 3. Pathology results

	Laparoscopic Surgery N=39	Open Surgery N=32	p value
Preoperative CRT (+)	19 (48.7%)	11 (36.7%)	
Pathologic Complete Response	3 (15.7%)	3 (30%)	p=0.369
Stg.1	4	-	
Stg.2	8	3	
Stg.3	4	3	
Stg.4	0	1	
Number of lymph nodes			p=0.16
-Median value	9	2	
-Range	1-31	0-14	
Positive resection margin	-	-	
-DRM			
-CRM			
Preoperative CRT (-)	20 (41.3%)	22 (68.75%)	
Stg.1	2	1	
Stg.2	8	6	
Stg.3	7	10	
Stg.4	2	2	
Tis	-	2	
Tumor-negative	1	1	
Number of lymph nodes			p=0.143
-Median value	16	10	
-Range	5-35	4-50	
Positive resection margin	-	-	
-DRM			
-CRM			

(DRM: distal resection margin; CRM: circumferential resection margin
Stg.: Stage; Tis: in situ carcinoma; CRT: chemoradiotherapy)

or specific complications. All patients with anastomotic leak in our study were male, all had locally advanced rectal cancer, low anastomosis, and all but one received preoperative therapy.

There was 1 patient in each group whose endoscopic polypectomy result was reported as invasive carcinoma with a positive surgical margin, but no tumor was detected upon examination of the main surgical specimen. In the open TME group, carcinoma in situ was detected in 2 patients. There were two stage 4 patients in each group, who underwent simultaneous open and laparoscopic liver metastasectomy. In the laparoscopic TME group, the rate of patients who received preoperative chemoradiotherapy was higher (48% vs. 36%). Based on whether they received preoperative chemotherapy, the results showed that within the group that received preoperative chemotherapy, patients who underwent open surgery had a higher rate of pathologic complete response, but the difference was not statistically significant. The median lymph node number was higher in the laparoscopy group. However, this difference was also not statistically significant. Within the subgroup that did not receive preoperative treatment, the lymph node number was again higher in the laparoscopy group. The difference was not statistically significant. CRM and DRM were negative in all patients in both groups (Table- 3).

The median follow-up time was 22 (6-36) months in the open group and 23 (6-36) months in the laparoscopic group. Median disease-free survival (DFS) was 26 (12-36) months in the open group and 24 (12-36) months in the laparoscopic group (p=0.98). During the follow-up, 3 patients in the open group and 4 patients in the laparoscopic group were lost. In the laparoscopic group, one patient died after 23 months in a traffic accident, and two patients died at 14 and 18 months due to disease. Three patients with liver metastases underwent metastasectomy at 17 and 18 months. Two of three patients, still alive had an overall survival (OS) of 23 months and the other 17 months. In the open group, one patient died at 10months and the other one died at 16 months due to acute cerebrovascular disease and pneumonia. Because of the local recurrence, two patients were operated at 12 and 4 months. They have been followed for 19 months and 32 months without any disease.

Discussion

Colorectal cancer is the third most common type of cancer worldwide and continues to be a major cause of morbidity and mortality. The use of minimally invasive surgical methods for the treatment of colon cancer has increased in recent years due to the growing evidence of equivalent short-term surgical and oncologic outcomes [3]. In our study, we aimed to assess our short-term surgical and oncological results for mid and low rectal cancer patients. At the same time, we aimed to evaluate overall and disease-free survival during the follow-up period.

As noted in numerous studies [1,4-7], since the technique is more challenging to perform and surgeons have less experience in it, laparoscopic surgery is associated with a significantly longer operative times. In our study, the median operative time was longer in the laparoscopy group, although the difference was not statistically significant. Also, it has been reported [1,4,8] that operative time can be reduced as technical experience and the number of experienced surgeons increase. When our surgical results of the last year were compared with previous ones, it was seen that there was no significant difference between the median operative time [190 (120-240) min. vs193 (130-300) min, p =0,67] . This can be explained by the increasing complexity of cases and the natural difficulty of the technique of performing open or laparoscopic surgery.

Despite its technical complexity, laparoscopic rectal cancer surgery may provide a more magnified view of the pelvic cavity compared to open surgery, which may facilitate resection of the mesorectum with a higher accuracy and greater ease [4]. According to our results, laparoscopic surgery provided significantly less blood loss, shorter length of incision. We believe that, especially in lower rectal cancers, the use of the laparoscopic approach facilitates intraoperative exploration, enables the detection and preservation of important anatomic structures, is associated with a smaller incision, less tissue damage, blood loss, which was also mentioned in different studies [1,4].

Although there was no significant difference in our study, complete regression rate (12-38%) after neoadjuvant chemoradiotherapy (nCRT) was higher in the open surgery group. Factors that predict pathologic complete response after nCRT in rectal cancers include different neoadjuvant therapeutic regimens [9-11], intervals between nCRT and surgery, histological type of tumor, signet ring cell histology, absence of circumferential involvement [9]. Due to the retrospective nature of our study and the application of preoperative medical treatments in different centers,

possible reasons that might have an effect on the statistically insignificant difference in the open surgery group could not be evaluated.

In our study, the number of lymph nodes removed was higher in the laparoscopy group, both among patients who received and did not receive neoadjuvant therapy. Furthermore, no DRM (distal resection margin) or CRM (circumferential resection margin) involvement was detected in either group. This indicates that the higher number of lymph nodes removed from laparoscopic patients who received preoperative therapy cannot be completely explained by the relatively higher proportion of preoperative therapy and higher response rate in the open surgery group, and that laparoscopy does not have an adverse impact on short-term oncological outcomes. In a meta-analysis [2] comparing the short- and long-term outcomes of these surgical approaches after neoadjuvant therapy in rectal cancer, as well as in many articles comparing removed lymph nodes, CRM, DRM, it was reported that the outcomes were significantly better in the laparoscopic group [3] or were similar between the groups [2, 12-17].

At the same time, two randomized controlled studies [18,19] raised concerns about the oncologic equivalence of the groups. They were unable to demonstrate noninferiority of the laparoscopic method compared to the conventional method for locally advanced rectal cancer. This was attributed to the difficulty of performing rectal surgery in the pelvic space, which is deep and narrow, with straight, rigid instruments used in the laparoscopic method. It was stated that open surgery may be better for this difficult area [19,20]. Although our follow-up time was not enough to make a conclusion about long-term oncological results, during the follow-up, 2 patients (6.25%) in the OG had a local recurrence and five patients (12.8%) in the LG had distant metastasis. Laparoscopy had no adverse effect on short-term oncological outcomes.

No significant difference was detected between the groups in terms of mortality, morbidity, and reoperation rates. The higher occurrence of anastomotic leaks in laparoscopic surgeries performed in the first 2 years may be attributed to experience. All patients with anastomotic leak in our study were male, all had locally advanced rectal cancer, low anastomosis, and all but one received preoperative therapy. Our results suggest that surgical experience, male gender, low anastomosis, locally advanced rectal cancer and preoperative therapy are factors that may increase the risk of anastomotic leak following laparoscopic rectal cancer surgery, as stated in different studies [21,22].

According to our results, especially in mid and lower rectal cancers, the use of the laparoscopic approach facilitates intraoperative exploration and enables the detection and preservation of important anatomic structures. This approach provides better surgical outcomes and does not have an adverse impact on short-term oncological outcomes, and also provides comparable results for surgical margins, local recurrence, and disease-free survival.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: *None*

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Ding Z, Wang Z, Huang S, Zhong S, Lin J. Comparision of laparoscopic vs. Open surgery for rectal cancer. Mol Clin Oncol. 2017;6(2):170-6.

2. Wang L, Zhang Z, Gong L, Zhan Y, Li M, Li S, et al. A Systematic Review and Bayesian Network Meta-Analysis: Short-Term and Long-Term Outcomes of Three Surgery Procedures Following Neoadjuvant Chemoradiotherapy for Rectal Cancer. J Laparoendosc Adv Surg Tech A. 2019;29(5):663-70.

3. Gilmore B, Adam M, Rhodin K, Turner MC, Ezekian B, Manty CR, et al. Evolution of minimally invasive surgery for rectal cancer: uptade from the national cancer database. Surgical Endosc. 2021;35(1):275-90.

4. Lu Y, Peng L, Ma Y, Liu Y, Ren L, Zhang L, et al. Comparision Between Laparoscopic and Open Resection Following Neoadjuvant Chemoradiotherapy for Mid-Low Rectal Cancer Patients; A Meta-Analysis. J Laparoendosc Adv Surg Tech A. 2019;29(3):316-22.

5. McKay GD, Morgan MJ, Wong SK, Gatenby AH, Fulham SB, Ahmet KW, et al. Improved short-term outcomes of laparoscopic versus open resection for colon and rectal cancer in an area health service: a multicenters study. Dis Colon Rectum. 2012;55(1):42–50.

6. Chen K, Zhang Z, Zuo Y, Ren S. Comparison of the clinical outcomes of laparoscopic-assisted versus open surgery for colorectal cancer. Oncol Lett. 2014;7(4):1213–18.

7. Park JS, Choi GS, Jun SH, Hasegawa S, Sakai Y. Laparoscopic versus open intersphincteric resection and coloanal anastomosis for low rectal cancer: intermediate-term oncologic outcomes. Ann Surg. 2011;254(6):941-6.

8. Yang Q, Xiu P, Qi X, Yi G, Xu L. Surgical margin sand short-term results of laparoscopic total mesorectal excision for low rectal cancer. JSLS. 2013;17(2):212– 18.

9. Cui J, Yang L, Guo L, Shao Y, Li N, Zhang H. Surgical management of patients with pathologic complete response in the primary tumor after neoadjuvant chemotherapy for rectal cancer. Zhonghua Zhong Liu Za Zhi. 2015;37(6):456-60.

10. Roh MS, Colangelo LH, O'Connell MJ, Yothers G, Deutsch M, Allegra CJ, et al. Preoperative multimodality therapy improves disease-free survival in patients with carcinoma of the rectum: NSABP R- 03. J Clin Oncol. 2009;27(31):5124-30

11. Marechal R, Vos B, Polus M, Delaunoit T, Peeters M, Demetter P, et al. Short course chemotherapy followed by concomitant chemoradiotherapy and surgery in locally advanced rectal cancer: a randomized multicentric phase II study. Ann Oncol. 2012;23(6):1525-30.

12. Ohtani H, Tamamori Y, Azuma T, Mori Y, Nishiguchi Y, Maeda K, et al. A meta-analysis of the short- and long-term results of randomized controlled trials that compared laparoscopy-assisted and conventional open surgery for rectal cancer. J Gastrointest Surg. 2011;15(8):1375–85.

13. Zhang FW, Zhou ZY, Wang HL, Zhang JX, Di BS, Huang WH, et al. Laparoscopic versus open surgery for rectal cancer: a systematic review and meta- analysis of randomized controlled trials. Asian Pac J Cancer Prev. 2014;15(22):9985–96.

14. Arezzo A, Passera R, Salvai A, Arolfo S, Allaix ME, Schwarzer G, et al. Laparoscopy for rectal cancer is oncologically adequate: a systematic review and meta-analysis of the literature. Surg Endosc. 2015;29(2):334–48.

15. Lujan J, Valero G, Hernandez Q, Sanchez A, Frutos MD, Parrilla P. Randomized clinical trial comparing laparoscopic and open surgery in patients with rectal cancer. Br J Surg. 2009;96(9):982-9.

16. Keller DS, Champagne BJ, Reynolds HL Jr, Stein SL, Delaney CP. Cost-effectiveness of laparoscopy in rectal cancer. Dis Colon Rectum. 2014;57(5): 564-9.

17. Bonjer HJ, Deijen CL, Abis GA, Cuesta MA, van der Pas MH, de Lange-de Klerk ES, et al. A randomized trial of laparoscopic versus open surgery for rectal cancer. N Engl J Med. 2015;372(14):1324-32

18. Fleshman J, Branda M, Sargent DJ, Boller AM, George V, Abbas M, et al. Effect of laparoscopic assisted resection vs open resection of stage II or III rectal cancer on pathologic outcomes: the ACOSOG Z6051 randomized clinical trial. JAMA. 2015;314(13):1346–55.

19. Chand M, Moran B, Wexner S. Which technique to choose in the high-tech era of minimal-access rectal cancer surgery? Colorectal Dis. 2016;18(9):839-41.

20. Stevenson AR, Solomon MJ, Lumley JW, Hewett P, Clouston AD, Gebski VJ, et al. Effect of laparoscopic-assisted resection vs open resection on pathological outcomes in rectal cancer: The ALaCaRT randomized clinical trial. JAMA. 2015;314(13):1356–63.

21. Marinatou A, Theodoropoulos GE, Karanika S, Karantanos T, Siakavellas S, Spyropoulos BG, et al. Do anastomotic leaks impair postoperative health-related quality of life after rectal cancer surgery? A case-matched Study. Dis Colon Rectum. 2014;57(2):158–66.

22. Park JS, Choi GS, Kim SH, Kim HR, Kim NK, Lee KY, et al. Multicenter analysis of risk factors for anastomotic leakage after laparoscopic rectal cancer excision: The Korean laparoscopic colorectal surgery study group. Ann Surg. 2013;257(4):665-71.

How to cite this article:
***Serdar Şenol, Servet Karagül, Oktay Karaköse.** Short-term results in mid and low rectal cancer with laparoscopic and open surgery. Ann Clin Anal Med 2022;13(1):30-34*